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IS 11654-3-103 (1989): Flexible insulating sleeving, Part 3: Specifications for individual types of sleeveings, Section 103: General purpose grade sleeving with unilateral tolerances with temperature index 90 [ETD 2: Solid Electrical Insulating Materials and Insulation Systems]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

**SPECIFICATION FOR FLEXIBLE INSULATING
SLEEVINGS**

PART 3 SPECIFICATIONS FOR INDIVIDUAL TYPES OF SLEEVINGS

**Section 103 General Purpose Grade Sleeving with Unilateral Tolerances with
Temperature Index 90**

भारतीय मानक

नम्य विद्युत-रोधी स्लीविंगों की विशिष्टि

भाग 3 एकल स्वरूप की स्लीविंग

**अनुभाग 103 तापमान सूचक 90 सहित एक पार्श्वीय छूटों वाली सामान्य
प्रयोजन की ग्रेड स्लीविंग**

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FOREWORD

This Indian Standard (Part 3/Sec 103) was adopted by the Bureau of Indian Standards on 18 July 1989, after the draft finalized by the Solid Electrical Insulating Materials Sectional Committee had been approved by the Electrotechnical Division Council.

It is intended to bring out a series of standards on flexible insulating sleeveings. This series will cover the following in various parts:

- Part 1 Definitions and general requirements,
- Part 2 Methods of tests, and
- Part 3 Specifications for individual types of sleeveings.

This standard (Part 3/Sec 103) covers the requirements of general purpose grade sleeving with temperature index 90 with Type 2 employing unilateral tolerances for the bore diameter.

The bilateral tolerances are given in Type 1 (Part 3/Sec 100). Unilateral tolerances given in this standard as Type 2 may also be used.

Each of Type 1 and Type 2 covers three levels of wall thickness, 'thin wall', 'standard wall' and 'thick wall', related to nominal bore diameter and with corresponding differences in requirements for breakdown voltages.

The sleeving is normally available in bore sizes 0.3 mm to 50 mm and in the following opaque colours:

Black, blue, brown, grey, green, orange, pink, red, turquoise, violet, white, yellow and green/yellow and in transparent form.

Polyvinyl chloride sleeveings for electrical purposes are, at present, covered in IS : 1951-1961 'Specification for polyvinyl chloride sleeving for electrical purposes'. With the publication of relevant section under Part 3 of the standard, this standard will be withdrawn.

In the preparation of this standard, assistance has been derived from IEC Doc : 15 C (Central Office) 204 Sheet 103, issued by the International Electrotechnical Commission (IEC).

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SPECIFICATION FOR FLEXIBLE INSULATING SLEEVINGS

PART 3 SPECIFICATIONS FOR INDIVIDUAL TYPES OF SLEEVINGS

Section 103 General Purpose Grade Sleeving with Unilateral Tolerances with Temperature Index 90

1 SCOPE

1.1 This standard (Part 3/Sec 103) contains requirements for non-heat shrinkable sleeving of circular cross section, extruded from PVC (polyvinyl chloride) for the general purpose grade sleeving with temperature index 90 with Type 2 sleeving employing unilateral tolerances on bore diameter.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
IS 11654 (Part 1) : 1986	Specification for flexible insulating sleeveings : Part 1 Definitions and general requirements
IS 11654 (Part 2) : 1986	Specification for flexible insulating sleeveings : Part 2 Methods of tests

3 DESIGNATION

3.1 The sleeving shall be identified by one of the following means:

- a) In words and numbers,
- b) By the designation which follows, and
- c) By both the above.

"IS : - 3 - 100 (or 101 to 105) — nominal bore size in mm — wall thickness level — colour.

Where a numerical code is required for the wall thickness level, midpoint of the range of permitted wall thicknesses may be used.

The addition of 'X' at the end of the identification indicates that one or more of the special requirements in **4.1.2** have been agreed and included on the purchase contract.

For example IS : . . . 3 - 103 - 0 - 8 - standard-white - X.

Any abbreviations used for colour shall comply with Type 2 in this case is Section 103 of IS : - 3.

4 REQUIREMENTS

4.1 General Requirements

4.1.1 Basic Requirements

- a) Sleeving shall comply with the general requirements stated in IS 11654 (Part 1) : 1986, and
- b) Requirements given in Tables 1 to 3 are Type 2.

4.1.2 Special Requirements

Where any of the properties listed in Table 2 are specified, the appropriate test procedure shall be employed and the value shall comply with the requirements given in the Table.

4.2 Dimensions

When tested by the methods described in IS 11654 (Part 2) : 1986 the sleeving shall comply with the appropriate requirements for tolerance on nominal bore diameter and with the requirements for wall thickness given in Table 3.

4.3 Breakdown Voltage

Breakdown voltage shall be determined at room temperature and at elevated temperature as appropriate to the grades, using one of the methods given in IS 11654 (Part 2) : 1986.

The results obtained shall comply with the requirements given in Tables 1 to 3 appropriate to the sleeving. The rate of application of voltage shall be 500 V/s or such that the required breakdown value is reached in between 10 and 20 seconds.

Table 1 Requirements
[*Clauses 4.1.1(b), 4.2 and 4.3*]

Sl No.	Property	IS 11654 (Part 2) : 1986 (Cl Ref)	Units	Max or Min	Type 2	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Density	4	g/cm ³	Max	1.5	See also Table 2
2.	Resistance to splitting	5	Percent	Min	50	Where the wall thickness does not permit a square section ring to be cut, the length may be increased to not more than 1.5 mm
3.	Resistance to soldering heat	7	—	—	Pass	Applicable to sleeving with nominal bore diameter up to and including 5 mm
4.	Resistance to pressure at elevated temperature	10	Percent	Max	65	Not applicable to sleeving with nominal bore diameter below 2 mm
5.	Thermal stability	11 (Method A)	Minutes	Min	200	
		11 (Method B)	Minutes	Min	20	
6.	Bending at low temperature	14	—	—	—	
7.	Tensile strength	19	MPa	Min	15.0	Specimens to be bent over mandrel shown in Table 4 at a temperature of —65°C or below At 250 ± 50 mm/min
8.	Elongation at break	19	Percent	Min	200	
9.	Insulation resistance	22	M Ohm	Min	10 ⁴	
	a) at room temperature					
	b) after damp heat				10 ³	
10.	Flame propagation	26 (Method A)	Seconds	Max	60	In addition, the indicator flag any one of the three tests shall not be burned nor shall flaming or glowing particles or flaming drops ignite the cotton
11.	Transparency	28	—	—	Pass	Applicable only when transparent sleeving is specified.
12.	Corrosive volatiles	33	Percent	Max	None above 8 percent is permissible	16 hours at 120 ± 2°C
13.	Thermal endurance	see Note	—	—	—	The end point shall be either twice the initial value of secant modulus at 100 percent extension or half the initial elongation at break determined in accordance with 19 of IS 11654 (Part 3) : 1986. This test need not be repeated unless the manufacturer has made a significant change in the composition or method of production of the material
14.	Temperature index at 20 000 hours	37	—	Min	90	

NOTE — The type of ageing oven has a profound effect on the rate of ageing of PVC. The rate of air change in the oven shall be 5 to 10 per hour.

Table 2 Special Requirements
[Clauses 4.1.1(b), 4.1.2, 4.2 and 4.3]

Sl No.	Property	IS : 11654 (Part 2) - 1986 (CI Ref)	Units	Max or Min	Type 2	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Density	4	g/cm ³	—	± 0.03	Maximum permitted deviation for manufacturers' declared values
2.	Flexibility*	18	mm	—	The surface of the polystyrene film shall not show significant loss of polish or transparency	For method of test, see Annex A
3.	Plasticizer migration	—	—	—		
4.	Colour fastness to light	34	—	—	The original colour shall be clearly identifiable	—

*To accommodate the range of flexibilities which exists, it is necessary for the test weight and test requirements to be specified in the purchase contract.

Table 3 Requirements for Breakdown Voltage and Dimensions : Type 2 General Purpose-Grade, Unilateral Positive Tolerances
[Clauses 4.1.1 (b), 4.1.2, 4.2 and 4.3]

Nominal Bore Dia	Tolerance on Bore Dia mm Plus (+) only	Thin Wall				Standard Wall				Thick Wall			
		Wall Thickness mm		Breakdown Voltage kV		Wall Thickness mm		Breakdown Voltage kV		Wall Thickness mm		Breakdown Voltage kV	
		Min	Max	Room Temp	105°C	Min	Max	Room Temp	105°C	Min	Max	Room Temp	105°C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
0.3	0.2	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
0.5	0.2	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
0.8	0.2	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
1.0	0.2	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
1.5	0.2	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
2.0	0.4	0.20	0.40	3.0	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
2.5	0.4	—	—	—	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
3	0.4	—	—	—	—	0.3	0.5	4.0	—	0.4	0.6	5.0	—
4	0.4	—	—	—	—	0.4	0.6	5.0	—	0.5	0.7	6.0	—
5	0.4	—	—	—	—	0.4	0.6	5.0	—	0.5	0.7	6.0	—
6	0.6	—	—	—	—	0.4	0.6	5.0	—	0.5	0.7	6.0	—
8	0.6	—	—	—	—	0.6	0.8	6.0	—	0.7	1.0	7.0	—
10	0.8	—	—	—	—	0.6	0.8	6.0	—	0.7	1.0	7.0	—
12	0.8	—	—	—	—	0.6	0.8	6.0	—	0.7	1.0	7.0	—
16	0.8	—	—	—	—	0.7	1.0	7.0	—	1.0	1.4	10.0	—
20	1.0	—	—	—	—	0.7	1.0	7.0	—	1.0	1.4	10.0	—
25	1.0	—	—	—	—	0.7	1.0	7.0	—	1.0	1.4	10.0	—
30	1.0	—	—	—	—	0.7	1.0	7.0	—	1.0	1.4	10.0	—
40	2.0	—	—	—	—	0.7	1.0	7.0	—	1.2	1.5	10.0	—
50	2.0	—	—	—	—	0.7	1.0	7.0	—	1.3	1.8	10.0	—

Table 4 Mandrel Diameters for Low Temperature Bend Test
(Table 1)

Bore Diameter	Mandrel Diameter	Bore Diameter	Mandrel Diameter
mm	mm	mm	mm
0.3	3	6	37
0.5	3	8	42
0.8	4	10	5
1.0	5	12	5
1.5	6	16	7
2.0	9	20	7
2.5	10	25	7
3	16	30	8
4	25	40	10
5	33	50	11

ANNEX A

(Table 2)

METHOD OF TEST FOR THE MIGRATION OF PLASTICIZER

A-1 NUMBER OF TEST SPECIMENS

A-1.1 Test three specimens.

A-2 FORM OF TEST SPECIMEN

A-2.1 Where size permits, slit the sleeving along its length and cut specimens at least 10 mm × 5 mm. Where this is impossible, use lengths of sleeving in full section.

A-3 PROCEDURE

A-3.1 Place the three specimens on a suitable piece of transparent polystyrene film (above

0.1 mm thick) and apply a plate to maintain contact between the sleeving and the film. Place the assembly in an oven at $70 \pm 2^\circ\text{C}$ for 24 ± 1 h. Remove the test specimens from the polystyrene film and examine the film with normal vision. Ignore slight loss of polish or transparency of the surface and any contact line left by the specimen.

A-4 REPORT

A-4.1 Report any significant loss of polish or transparency of the film where it has been in contact with the sleeving.

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